AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the application.

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Listing of Claims

1. (original) A method of detecting misfire in an engine comprising:

detecting engine speed fluctuations;

determining a linear model for estimating engine firing events based on the engine speed fluctuations;

applying a Kalman filter to the linear model to determine parameters of the linear model; and

detecting a misfire event in the engine based on the linear model.

2. (original) The method of claim 1 further comprising representing the linear model as a difference equation.

3. (original) The method of claim 2 further wherein applying the Kalman filter includes estimating parameters of the difference equation.

4. (original) The method of claim 1 further comprising reformulating the linear model using standard state space systems equations.

5. (original) The method of claim 1 further comprising determining a load compensator signal based on an engine speed and a manifold absolute pressure, wherein detecting the misfire event includes detecting the misfire event based on the firing event signal and the load compensator signal.

6. (original) A method of detecting misfire in an engine comprising:

detecting crankshaft speed fluctuations in the engine;

determining a linear model for estimating engine firing events based on the crankshaft speed fluctuations;

representing the linear model as a difference equation;

estimating parameters of the difference equation at a Kalman filter to determine a firing event model; and

detecting a misfire event in the engine based on the firing event model.

7. (previously presented) A misfire detection system that detects misfire in an engine comprising:

a sensor that determines speed fluctuations of the engine;

a controller that determines a firing event model for estimating engine firing events based on the speed fluctuations of the engine and applies a Kalman filter to the model to estimate parameters of the model,`; and

a misfire detector that detects a misfire event based on the model.

8. (original) A misfire detection system according to claim 7 wherein the firing event model is a difference equation.

9. (original) A misfire detection system according to claim 8 wherein the Kalman filter estimates parameters of the difference equation.

10. (original) The method of claim 7 wherein the controller determines a load compensator signal based on an engine speed and a manifold absolute pressure, and wherein the misfire detector detects the misfire event based on the firing event model and the load compensator signal.

11. (withdrawn) A method of detecting misfire in an engine comprising:

drawing a nonlinear, dynamic model of a firing system for the engine using engine speed, manifold absolute pressure and a firing event signal;

simplifying the nonlinear, dynamic model by separating it into an engine firing event estimator function and an engine load compensator function;

expressing the engine firing event estimator function as a difference equation having a plurality of unknown model parameters and a measurement noise factor;

utilizing a system identification technique to estimate values for the model parameters;

determining a firing event signal using the firing event estimator; and

detecting a misfire event using the firing event signal.

12. (withdrawn) The method of claim 11 wherein the system identification technique comprises a Kalman filter.

13. (withdrawn) The method of claim 11 wherein the engine load compensation function comprises a function of engine speed and manifold absolute pressure.

14. (withdrawn) The method of claim 13 wherein the engine load compensation function is implemented as a look-up table.

15. (withdrawn) the method of claim 13 wherein the engine load compensator function is implemented as a surface map.

16. (withdrawn) The method of Claim 11 wherein the difference equation is of the form

$$y(k) = b_o N(k) + b_1 N(k-1) + \ldots + b_m N(k-m) + v(k)$$

where $b_o \ldots b_m$ are the model parameters and N is the engine speed at sample k, $k-1$, $\ldots k-m$, where k and m are integers.

17. (new) The method of claim 3 wherein the linear model is an inverse linear model of a linear model of engine crankshaft speed.

18. (new) The method of Claim 17 wherein the difference equation is of the form

$$y(k) = b_o N(k) + b_1 N(k-1) + \ldots + b_m N(k-m) + v(k)$$

where $b_o \ldots b_m$ are the model parameters and N is the engine speed at sample k, $k-1$, $\ldots .k-m$, where k and m are integers, and applying the Kalman filter to estimate parameters of the difference equation includes applying the Kalman filter to estimate the model parameters.